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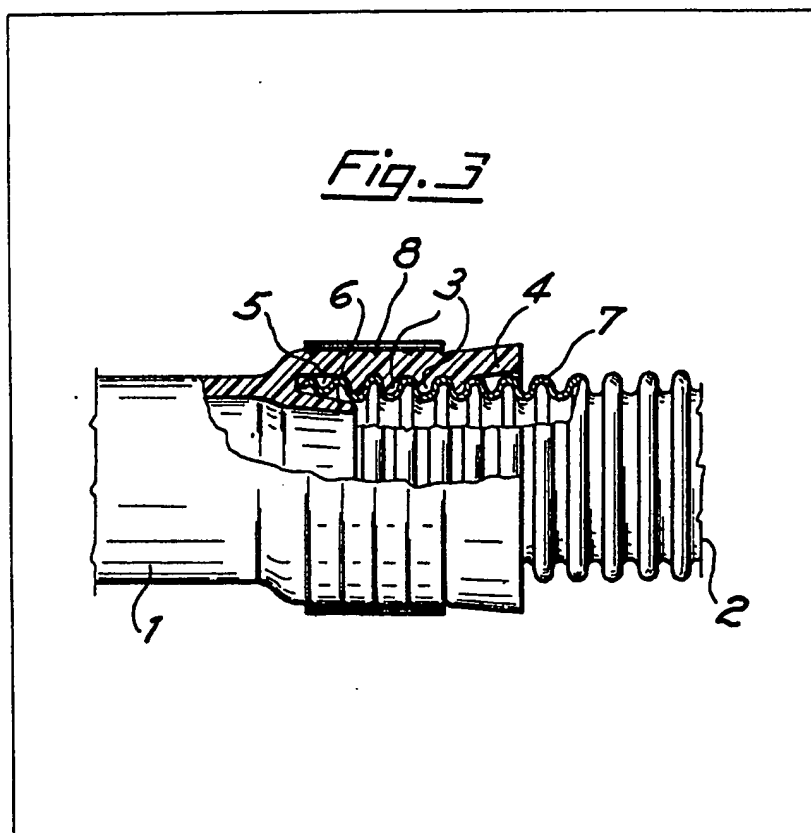
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**(54) An improved connection for tubes of elastomer material**

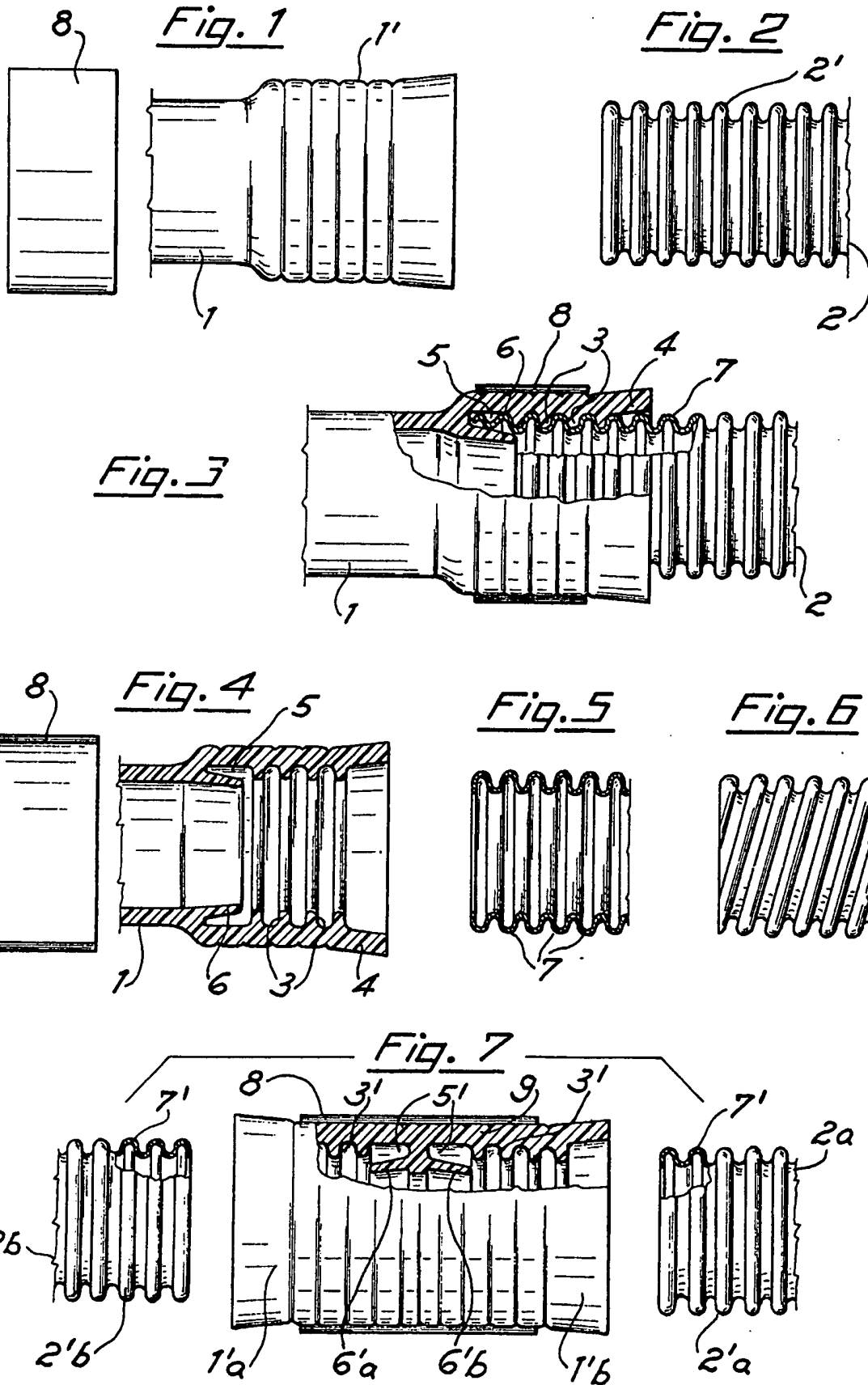
(57) In an improved connection between a first tube (2) of elastomer material and a second tube (1) of the same material, or a sleeve or a pipe fitting, wherein the ends of the two parts to be joined are of different

diameters so as to be telescoped in each other, and are provided with matching annular ridges (7) and hollows (3), the end of the tube of larger diameter is internally provided with an annular cavity (5) formed by the inner smooth wall of the tube and a frusto-conical projecting ring (6) integral with the body of said tube (2).



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## SPECIFICATION

## An improved connection for tubes of elastomer material

- This invention relates to an improved connection between tubes of elastomer material, or between a tube of elastomer material and a sleeve, a pipe fitting, or directly the user apparatus.
- More particularly, this invention relates to an improved connection between tubes, or between a tube and a sleeve or an outlet or inlet pipe fitting of a user apparatus, wherein a flow is required of fluids, either gaseous, liquid, or powder or granulated solids.
- In many apparatuses, particularly in those of semi-fixed type, it is well known the need of using flexible pipes both for ensuring a perfect connection and for convenient assembling and for avoiding vibration transmission.
- All of the household electrical appliances and transport tanks of general fluids are typical examples.
- To assure flexibility, all of the pipings are made of more or less deformable elastomer material and more or less reinforced depending on the pressures such pipings have to withstand and flow to be provided for. The deformability of these pipings, enabling a ready coupling, also causes a yielding under the fluid pressure which, by acting in any direction, also exerts a thrust along the axis and tends to unthread the tube.
- In order to avoid such a drawback, there is the trend of imparting a particular profile to the rubber carrier and clamping the resilient tube or hose onto the rubber carrier by metal clamps tensioned by means of screws or small bolts.
- This connecting system has the disadvantage that said metal clamps particularly in humid environments are subjected to oxidation and breakage, whereby such clamps cannot be used for many times and are not very resisting. Further, said metal clamps are rather unpractical, anti-aesthetical and assembling thereof requires an increase in cost and labour.
- Clamps of stainless steel and accordingly of high cost or clamps of high toughness plastic material have been adopted. However, such clamps have been suitable only for reduced pressures and diameters.
- Attempts have also been made to reduce assembling times and costs, by totally removing such locking clamps, or replacing such clamps with fixed rings.
- From the British patent application 8117358 a connection for tubes is known, in which the ends of each tube or part to be joined are of different diameter so as to be fixedly telescoped into each other and are provided with juxtaposed, complementary and matching annular ridges or hollows, as well as joined.
- However, this type of connection does not enable to provide satisfactory sealings when the fluid pressure is very high and where the outer tube is highly resiliently deformable with respect

- to the inner tube or pipe fitting. Thus, under these conditions, the fluid, by leaking between the superimposed ends of the tubes, would exert some pressure on both the inner tube and outer tube. As a result of this pressure, the inner tube maintains its shape unchanged, by being subjected to a same pressure on both the surfaces thereof, whereas the superimposed end of the outer tube would tend to expand, facilitating the fluid drawing or leaking and disconnection of the outer tube.
- It is the object of the present invention to provide an improved connection for tubes of elastomer material, which connection is free of the above mentioned disadvantages.
- More particularly, it is the object of the present invention to provide an improved connection for tubes of elastomer material which, in addition to being of practical use, does not require any increase in cost and not liable to oxidation, and enables to obtain a perfect sealing at high pressures, even for resiliently deformable tubes.
- It has now been found that these and further objects are accomplished according to the present invention by a connection between a first tube of elastomer material and a second tube of the same material, or a sleeve or a pipe fitting of a user apparatus, in which the ends of the two parts to be joined are of different diameters so as to be fixedly telescoped into each other, are provided with complementary juxtaposed annular ridges and hollows, and at the end of said ridges and hollows the end of the tube or larger diameter is internally provided with an annular cavity of frusto-conical cross-section, formed by the inner smooth wall of the tube and a projecting frusto-conical ring integral with the body of said tube.
- When the two tubes are joined to each other, the free end of the tube of minor diameter fits into the frusto-conical annular cavity and is urged against the inner wall of the outer tube by the frusto-conical ring of the annular cavity, increasing the pressure of said ring on the ridges of the inner tube. The connection may be carried out between tubes of elastomer material, in which one tube has the end to be joined of larger diameter and on the inner surface thereof is provided with annular hollows, while the other tube is on the outer surface thereof provided with complementary annular ridges.
- Said connection could also be carried out between a tube of elastomer material and a sleeve or an outlet or inlet mouth of a user apparatus, such as for example a household electrical appliance. In this case, the sleeve and mouth are of the same profile as the inner tube and on the outer surface thereof the tube is fitted having the end of larger diameter and provided with inner hollows.
- A connection according to the present invention could also be used for interconnection of tubes having a same diameter. In this case, a sleeve is used as having the two ends of larger diameter, so that the ends to the tubes to be joined can be inserted therein. The inner surface of

each sleeve end is provided with annular ridges and hollows, and internally with an annular cavity defined by the sleeve surface and a projecting frusto-conical ring fast with the body of said sleeve. Correspondingly, the ends of the tubes to be joined have on the outer surface thereof complementary ridges and hollows opposite to those on the sleeve.

The ridges and hollows may be circular, helical or of any other shape. Said ridges and hollows could be replaced with simple relief scorings or finings, provided at the free end of each tube to be joined and located at short distance from one another.

In order to assure an increased sealing, a ring of any rigid or resilient material can be inserted outwardly of the coupling zone, the ring being manually forcibly fitted by a simple slide in axial direction.

The connection of the tubes or the tube to the sleeve or mouth is carried out by axial slide of one end into the other end. During this axial slide, the ridges and hollows are temporarily deformed and then restored to initial configuration and position, when each ridge of one end is fixed into the corresponding hollow of the other end to be joined, and vice versa. Moreover, the end of the inner tube is inserted and exactly fitted in the annular cavity of frusto-conical cross-section provided on the inner surface of the end of the outer tube.

Once the two tubes or parts have been joined, disconnection thereof can be effected by merely drawing the two ends in removal direction thereof after unthreading of the safety ring, should the latter have been inserted.

The functional and constructive features of the connection according to the present invention can be more clearly understood from the following description, in which reference is made to the figures of the accompanying drawings, showing by way of unrestrictive example an embodiment of the present invention, and in which:

Fig. 1 is an external perspective view showing the end portion of a tube of larger diameter and a ring that can be fitted thereon;

Fig. 2 is an external perspective view showing the end portion of the inner component for the connection;

Fig. 3 is a perspective and partly cutaway view showing the two components of the connection as nested into each other and clamped by a ring;

Figs. 4 and 5 are cross-sectional views of the two end portions shown in Figs. 1 and 2, respectively;

Fig. 6 is an external perspective view showing the end portion of the inner component for the connection provided with annular ridges and hollows of helical pattern; and

Fig. 7 is a schematic perspective and partly cutaway view showing the connection components where the two ends are of a same diameter and where use is made of a connecting and joining sleeve arranged externally of the two ends to be joined.

In the figures of the accompanying drawings the connection is shown between two tubes 1 and 2 of elastomer material, but it is understood that the same connection could be carried out between a tube of elastomer material 1 and a pipe fitting or a sleeve or directly to the user apparatus.

Particularly referring to Figs. 1 through 6, a tube 1 of elastomer material, such as rubber or plastic, has the end 1' of larger diameter than that of the tube, so that the diameter of the inner wall of said end 1' is slightly larger than the outer diameter of tube 1.

The inner face of said end 1' has the essential peculiarity of being provided with annular scorings or hollows 3 of a constant pitch, preceded by a lead-in frusto-conical section 4 and followed by an annular cavity 5, formed by the inner smooth wall of the tube and a frusto-conical lip or ring 6 integral with the body of said tube 1.

The end 2' of tube 2 to be joined, which in the remaining section may be smooth or of spiral configuration, is provided with a plurality of rings or ridges 7 complementary to the annular scorings 3. Preferably, the inner wall of said tube 2 may be of annular configuration, as shown in Figs. 3, 5 and 7, or may be smooth.

The connection is carried out as shown in Fig. 3 and is provided by urging said end 2' into and within said end 1'. In this inserting operation, said end 2' is guided by the initial frusto-conical ring 4, and continues in said end 1' until inserting in the annular cavity 5, while the various rings 7 set into the counter-seats 3.

A particular important novelty of the present invention is that the initial rings 7, or the rings arranged at the free end of end 2', are compressed by the frusto-conical wall of the annular lip 6 against the inner surface of tube 1, thus creating an immediate double sealing.

Moreover, under load, when tending to resiliently deform, the end section 1' draws along also the frusto-conical lip 6, thus maintaining said rings 7 under pressure.

As a result, a safe sealing is provided against both fluid leakage and axial disconnection of the two tubes.

No further expedient would be required for not too high pressures of fluid such as those found, for example, in free discharges of household electrical appliances.

On the other hand, where the fluid pressure is very high, or with tubes of very large diameter, sealing is preferably ensured by a safety ring 8 of continuous circular cross-section and made of a more rigid material than the elastomer comprising said tube 1, which is forcibly fitted at the connection.

Said rings 7 of end 2', hitherto indicated as parallel to one another and perpendicular to the tube axis, could also be of spiral pattern, as shown in Fig. 6; in this case, said frusto-conical lip 6 would resiliently deform the same and cause them to adhere to the corresponding annular wall of end 1'.

Fig. 7 shows a particular embodiment of the

present invention for interconnecting two tubes 2a and 2b of a same diameter. According to the present invention, in such an embodiment use is made of a sleeve 9 having the two ends 1'a and 1'b identical to each other and each of which provided, as the above described end 1', with annular scorings or hollows 3' and an annular cavity 5' defined by the frusto-conical lip 6'a and 6'b, respectively.

10 The ends 2'a and 2'b of the two tubes 2a and 2b to be joined are inserted in the two ends 1'a and 1'b of said sleeve 9 and urged until the free end of said ends insert in the respective cavities 5' and the various rings 7' in the hollows 3'.

15 After assembling, the safety ring 8 can be inserted by slight pressure on said sleeve 9 and fitted by slight slide, preferably before insertion of the two tubes.

20 The invention is not limited to any particular material and can be extended to various forms of sleeves or by-passes. Further, said tube 2 could also be the inlet or outlet mouth of the user apparatus. In carrying into practice the present invention, changes, modifications or variations to the embodiments shown in the figures of the accompanying drawings can be made within the spirit of the present invention and without departing from the covering scope thereof.

#### CLAIMS

30 1. An improved connection between a first tube of elastomer material and a second tube of the same material or a sleeve or a pipe fitting, wherein

the ends of the two tubes or parts to be joined are of different diameters so as to be fixedly

35 telescoped into each other and are provided with complementary juxtaposed annular ridges and hollows, characterized in that the end of the tube of larger diameter is at the end of said ridges and hollows internally provided with an annular cavity 40 of frusto-conical cross-section, formed by the inner wall of the tube and a projecting frusto-conical ring integral with the body of said tube.

2. An improved connection according to Claim 1, characterized in that said ridges and hollows are of circular or helical pattern.

3. An improved connection according to Claim 1 or 2, characterized in that said ridges and hollows are provided on the outer surface of the part to be joined having minor diameter and on the 50 inner surface of the other part to be joined having larger diameter.

4. An improved connection according to any of the preceding claims, wherein the connection is provided by using a sleeve having the two ends of 55 larger diameter than that of the two tubes, and wherein each is on the inner surface provided with complementary juxtaposed annular ridges and hollows, and at the end of said ridges and hollows with an annular cavity of frusto-conical cross-section formed by a projecting frusto-conical ring 60 integral with the body of said tube, each tube to be joined being pressure inserted in each of the ends.

5. An improved connection according to any of the preceding claims, characterized in that a ring is 65 forcibly fitted at the coupling zone.